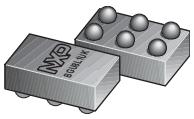
THE DATASHEET OF

BGU8L1UKAZ



BGU8L1UK

SiGe:C Low Noise Amplifier MMIC for LTE

Rev. 1 — 19 May 2015 Product data sheet

1. Product profile

1.1 General description

The BGU8L1UK is a Low Noise Amplifier (LNA) for LTE receiver applications. It comes as an extremely small and thin Wafer Level Chip Scale Package (WLCSP). The BGU8L1UK requires one external matching inductor.

The BGU8L1UK adapts itself to the changing environment resulting from co-habitation of different radio systems in modern cellular handsets. It has been designed for low power consumption and optimal performance. At low jamming power levels it delivers 16 dB gain at a noise figure of 0.7 dB. During high power levels, it temporarily increases its bias current to improve sensitivity.

The BGU8L1UK is optimized for 728 MHz to 960 MHz.

1.2 Features and benefits

- Operating frequency from 728 MHz to 960 MHz
- Noise figure (NF) = 0.7 dB
- Gain = 16 dB
- High input 1 dB compression point of −6 dBm
- High in band $IP3_i$ of 2 dBm
- Supply voltage 1.5 V to 3.1 V
- Self shielding package concept
- Integrated supply decoupling capacitor
- Optimized performance at a supply current of 4.7 mA
- Power-down mode current consumption < 1 μA
- Integrated temperature stabilized bias for easy design
- Require only one input matching inductor
- Output DC decoupled
- ESD protection on all pins (HBM > 2 kV)
- Integrated matching for the output
- Extremely small Wafer Level Chip Scale Package (WLCSP) 0.65 × 0.44 × 0.2 mm; 6 solder bumps; 0.22 mm bump pitch
- 180 GHz transit frequency - SiGe:C technology

1.3 Applications

- LNA for LTE reception in smart phones, feature phones, tablet PCs and RF front-end modules.

1.4 Quick reference data

Table 1. Quick reference data

f = 882 MHz; V_{CC} = 2.8 V; $V_{I(ENABLE)} \geq 0.8$ V; T_{amb} = 25 °C; input matched to 50 Ω using a 18 nH inductor; unless otherwise specified.

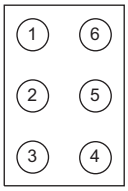
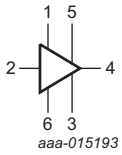
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		1.5	-	3.1	V
I_{CC}	supply current		-	4.7	-	mA
G_p	power gain	[1]	-	16.0	-	dB
NF	noise figure	[1][2]	-	0.7	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	[1]	-	−6	-	dBm
$IP3_i$	input third-order intercept point	[1]	-	2	-	dBm

[1] E-UTRA operating band 5 (869 MHz to 894 MHz).

[2] PCB losses are subtracted.

2. Pinning information

Table 2. Pinning

Pin	Description	Simplified outline	Graphic symbol
1	ENABLE	 Bump side view	
2	RF_IN		
3	GND_RF		
4	RF_OUT		
5	V_{CC}		
6	GND		

3. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BGU8L1UK	WLCSP6	wafer level chip-size package; 6 balls; 0.65 × 0.44 × 0.29 mm	WLCSP6

4. Marking

Table 4. Marking codes

Type number	Marking code
BGU8L1UK	single character, indicating assembly month.[1]

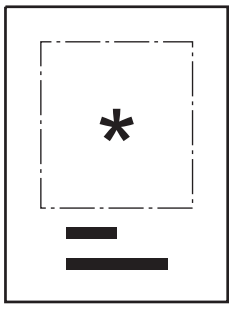
[1] Month code see Table 5.

Table 5. Calender marking month code

Asterisk (*) in Figure 1 is replaced by character in table.

Year [1]	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
2014	Y	Z	b	d	f	h	3	4	5	6	7	9
2015	A	B	C	D	E	F	G	H	I	J	K	L
2016	M	N	O	P	Q	R	S	T	U	V	W	X

[1] Rotates every 3 years.



Pin 1 location: the marking stripes below character indicate the side where pin 1 is located.

Fig 1. Marking code description example

5. Limiting values

Table 6. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage	RF input AC coupled [1]	–0.5	+5.0	V
$V_{I(ENABLE)}$	input voltage on pin ENABLE	$V_{I(ENABLE)} < V_{CC} + 0.6$ V [1][2]	–0.5	+5.0	V
$V_{I(RF\_IN)}$	input voltage on pin RF_IN	DC, $V_{I(RF\_IN)} < V_{CC} + 0.6$ V [1][2]	–0.5	+5.0	V
$V_{I(RF\_OUT)}$	input voltage on pin RF_OUT	DC, $V_{I(RF\_OUT)} < V_{CC} + 0.6$ V [1][2][3]	–0.5	+5.0	V
P_i	input power	[1]	-	10	dBm
P_{tot}	total power dissipation	$T_{sp} \leq 130$ °C	-	55	mW
T_{stg}	storage temperature		–65	+150	°C
T_j	junction temperature		-	150	°C
V_{ESD}	electrostatic discharge voltage	Human Body Model (HBM) According to ANSI/ESDA/JEDEC standard JS-001	-	±2	kV
		Charged Device Model (CDM) According to JEDEC standard JESD22-C101C	-	±1	kV

[1] Stressed with pulses of 200 ms in duration.

[2] Warning: due to internal ESD diode protection, the applied DC voltage shall not exceed V_{CC} + 0.6 V and shall not exceed 5.0 V in order to avoid excess current.

[3] The RF output is AC coupled through internal DC blocking capacitors.

6. Recommended operating conditions

Table 7. Operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		1.5	-	3.1	V
T_{amb}	ambient temperature		−40	+25	+85	°C
$V_{I(ENABLE)}$	input voltage on pin ENABLE	OFF state	-	-	0.3	V
		ON state	0.8	-	-	V

7. Thermal characteristics

Table 8. Thermal characteristics

Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point		225	K/W

8. Characteristics

Table 9. Characteristics at V_{CC} = 1.8 V

728 MHz ≤ f ≤ 960 MHz; V_{CC} = 1.8 V; $V_{I(ENABLE)}$ ≥ 0.8 V; T_{amb} = 25 °C; input matched to 50 Ω using a 18 nH inductor; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CC}	supply current	$V_{I(ENABLE)}$ ≥ 0.8 V	-	4.3	-	mA
		$V_{I(ENABLE)}$ ≤ 0.3 V	-	-	1	µA
G_p	power gain	f =740 MHz [1]	-	16.5	-	dB
		f = 882 MHz [2]	-	16.0	-	dB
		f = 943 MHz [3]	-	15	-	dB
RL_{in}	input return loss	f =740 MHz [1]	-	8	-	dB
		f = 882 MHz [2]	-	9	-	dB
		f = 943 MHz [3]	-	8	-	dB
RL_{out}	output return loss	f =740 MHz [1]	-	12	-	dB
		f = 882 MHz [2]	-	12	-	dB
		f = 943 MHz [3]	-	12	-	dB
ISL	isolation	f =740 MHz [1]	-	25	-	dB
		f = 882 MHz [2]	-	25	-	dB
		f = 943 MHz [3]	-	25	-	dB
NF	noise figure	f =740 MHz [1][4]	-	0.7	-	dB
		f = 882 MHz [2][4]	-	0.7	-	dB
		f = 943 MHz [3][4]	-	0.8	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	f =740 MHz [1]	-	−12	-	dBm
		f = 882 MHz [2]	-	−10	-	dBm
		f = 943 MHz [3]	-	−9	-	dBm

Table 9. Characteristics at V_{CC} = 1.8 V *…continued*

728 MHz ≤ f ≤ 960 MHz; V_{CC} = 1.8 V; $V_{I(ENABLE)}$ ≥ 0.8 V; T_{amb} = 25 °C; input matched to 50 Ω using a 18 nH inductor; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$IP3_i$	input third-order intercept point	f =740 MHz [1]	-	–6	-	dBm
		f = 882 MHz [2]	-	–4	-	dBm
		f = 943 MHz [3]	-	–3	-	dBm
K	Rollett stability factor		1	-	-	
t_{on}	turn-on time	time from $V_{I(ENABLE)}$ ON, to 90 % of the gain	-	-	3	µs
t_{off}	turn-off time	time from $V_{I(ENABLE)}$ OFF, to 10 % of the gain	-	-	1	µs

[1] E-UTRA operating band 17 (734 MHz to 746 MHz).

[2] E-UTRA operating band 5 (869 MHz to 894 MHz).

[3] E-UTRA operating band 8 (925 MHz to 960 MHz).

[4] PCB losses are subtracted

Table 10. Characteristics at V_{CC} = 2.8 V

728 MHz ≤ f ≤ 960 MHz; V_{CC} = 2.8 V; $V_{I(ENABLE)}$ ≥ 0.8 V; T_{amb} = 25 °C; input matched to 50 Ω using a 18 nH inductor; unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_{CC}	supply current	$V_{I(ENABLE)}$ ≥ 0.8 V	-	4.7	-	mA
		$V_{I(ENABLE)}$ ≤ 0.3 V	-	-	1	µA
G_p	power gain	f =740 MHz [1]	-	16.5	-	dB
		f = 882 MHz [2]	-	16.0	-	dB
		f = 943 MHz [3]	-	15.5	-	dB
RL_{in}	input return loss	f =740 MHz [1]	-	8	-	dB
		f = 882 MHz [2]	-	10	-	dB
		f = 943 MHz [3]	-	8	-	dB
RL_{out}	output return loss	f =740 MHz [1]	-	12	-	dB
		f = 882 MHz [2]	-	12	-	dB
		f = 943 MHz [3]	-	12	-	dB
ISL	isolation	f =740 MHz [1]	-	25	-	dB
		f = 882 MHz [2]	-	25	-	dB
		f = 943 MHz [3]	-	25	-	dB
NF	noise figure	f =740 MHz [1][4]	-	0.7	-	dB
		f = 882 MHz [2][4]	-	0.7	-	dB
		f = 943 MHz [3][4]	-	0.8	-	dB
$P_{i(1dB)}$	input power at 1 dB gain compression	f =740 MHz [1]	-	–7	-	dBm
		f = 882 MHz [2]	-	–6	-	dBm
		f = 943 MHz [3]	-	–5	-	dBm
$IP3_i$	input third-order intercept point	f =740 MHz [1]	-	–1	-	dBm
		f = 882 MHz [2]	-	2	-	dBm
		f = 943 MHz [3]	-	1	-	dBm
K	Rollett stability factor		1	-	-	
t_{on}	turn-on time	time from $V_{I(ENABLE)}$ ON, to 90 % of the gain	-	-	3	µs
t_{off}	turn-off time	time from $V_{I(ENABLE)}$ OFF, to 10 % of the gain	-	-	1	µs

[1] E-UTRA operating band 17 (734 MHz to 746 MHz).

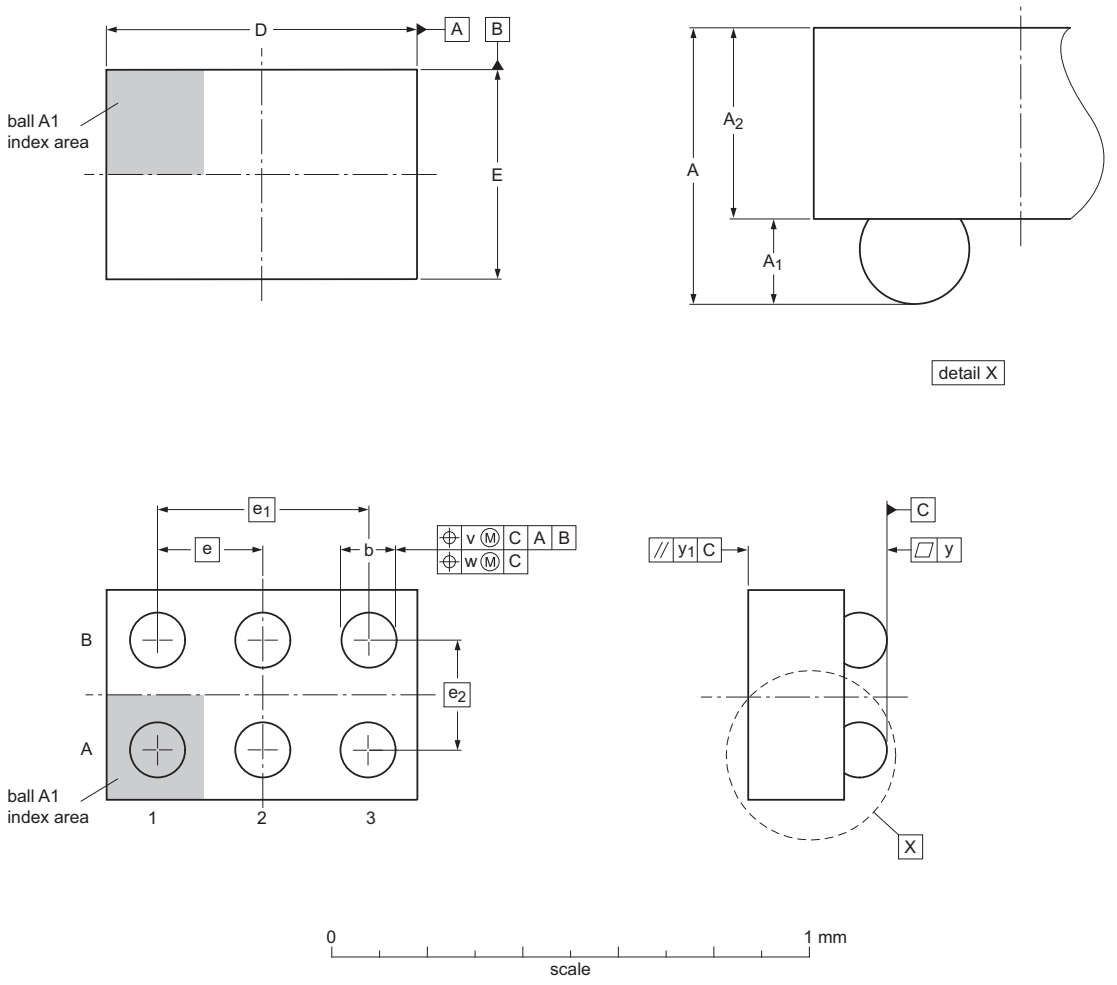
[2] E-UTRA operating band 5 (869 MHz to 894 MHz).

[3] E-UTRA operating band 8 (925 MHz to 960 MHz).

[4] PCB losses are subtracted

9. Package outline

WLCSP6: wafer level chip-size package; 6 balls; 0.65 x 0.44 x 0.29 mm **BGU8L1UK**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	b	D	E	e	e_1	e_2	v	w	y	y_1
mm	max	0.32	0.105	0.215	0.131	0.68	0.47							
	nom	0.29	0.090	0.200	0.116	0.65	0.44	0.22	0.44	0.23	0.05	0.05	0.05	0.1
	min	0.26	0.075	0.185	0.101	0.62	0.41							

wlcsp6_bgu8l1uk_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
BGU8L1UK						~~14-08-25~~ 14-12-01

Fig 2. Package outline BGU8L1UK (WLCSP6)

10. Handling information

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.

Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards.

11. Abbreviations

Table 11. Abbreviations

Acronym	Description
ESD	ElectroStatic Discharge
E-UTRA	Evolved Universal Terrestrial Radio Access
HBM	Human Body Model
LTE	Long Term Evolution
MMIC	Monolithic Microwave Integrated Circuit
PCB	Printed Circuit Board
SiGe:C	Silicon Germanium Carbon

12. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BGU8L1UK v.1	20150519	Product data sheet	-	-

13. Legal information

13.1 Data sheet status

Document status[1][2]	Product status[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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15. Contents

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